UNIVERSITY OF PENNSYLVANIA

THE VALUE OF CHRONOLOGICAL AGE, MENTAL AGE, NUMBER OF PERMANENT TEETH, AND KINDERGARTEN TRAINING FOR PREDICTING PROMOTION IN THE FIRST GRADE

REINHOLD WEIMAR GOLL

A THESIS

IN EDUCATION

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

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REINHOLD W. GOLL.

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I

The Problem

School failure and its causes are the concern of all school workers. Every failure of every child represents a real loss. This loss is varied in character. The most obvious effect of failure is the necessity for providing reinstruction to the failure pupil, with the attendant duplication of all the costs involved. The annual cost of reteaching failure pupils throughout the United States has been estimated at $80,000,000.[1] In the Philadelphia Public Schools alone the actual financial cost of reinstructing pupils who were not promoted for the term ending in January, 1926, was placed at $1,353,477.89. Of this sum $817,268.12 was spent for reteaching the elementary school failures.[2]

Undesirable mental effects on children have been attributed to school failure. The non-promoted pupil may lose confidence in his ability, or become discouraged. He may lose interest and relax effort to such an extent as to induce a repetition of his failure. Failure may engender dislike for school with consequent truancy. When a child fails he is not only branded a failure, but the inspiring stimulus of success is denied him.

Repeated failures ultimately exert an unfavorable influence on every child in the school because the failure child becomes over-age for the grade and socially misplaced. These failures widen the range of school ability within a class to such an extent that the average teacher has several distinct pedagogical groups in her class, with the consequent handicap on offering the best instruction to any.

School failure should be eliminated or reduced wherever possible, and the most appropriate field for this reduction is where it begins, and where it takes its heaviest toll—the first grade. That the first grade shows the greatest failure in the

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[1] *Pennsylvania School Journal*, March, 1928, p. 444.

[2] Division of Educational Research, *Phila. Board of Public Education Bulletin No. 2*, May, 1926, p. 41.

elementary school is very definitely recognized[3, 4]. In the average city from 20 to 25 per cent of the pupils fail in the first grade. Where the first grade failure is lower than this it is still considerably higher than the failure rate in any other grade.[5] Within the first grade the available data show that where there are two promotion periods for the first year, the promotion rate for the first term is appreciably lower than that for the second term.

In Philadelphia, where the present study was made, the promotion rates by grade and section, for the elementary schools, for the term ending January, 1927, were as follows:[6]

Grade.....	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6A	6B
Percentage of Promotion...	75.3	81.8	86.4	88.0	87.6	88.7	88.8	88.7	87.9	89.5	89.9	91.2

In other words school failure is greatest among school entrants. At the very outset of their school careers, approximately one-quarter of our school entrants are destined to fail and lose the inspiration of success.

Perhaps the chief reason for excessive non-promotion in the first grade is that, in most communites, the first grade is the only one to which entrance is granted solely on the chronological age of the applicant. Regulations prescribing a definite chronological age for school admission, usually six years, are recognized as purely arbitrary.

Since the first grade is so critical for the child, it is the grade above all others where the raw material should be carefully assayed to determine the most profitable disposition for every case. With chronological age as the guide, many children are now admitted to conventional first grade work who are too

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[3] Terman, Lewis M., *The Intelligence of School Children*, Chapter IV, p. 42, 1919.

[4] Percival, Walter, "Study of the Causes and Subjects of School Failure," *California Curriculum Study*, 1927.

[5] Division of Educational Research, *Philadelphia Board of Public Education Bulletin No. 44*, May, 1927, p. 15.

[6] Division of Educational Research, *Phila. Board of Public Education Bulletin No. 44*, May, 1927, p. 16.

immature to succeed at once, and, of course, some are banned who would be entirely successful in the first grade.

First grade teachers, as a unit, believe they are expected to teach some children who are not ready for their work, and whose only fault is that they are "too babyish", "too immature"; children who, despite conformity to chronological age regulations and apparent normal intelligence, "need another term in kindergarten."[7]

Perhaps the best expression of dissatisfaction with prevailing practice in school admission comes from William H. Burnham: "Without examination all the children of the chronological age of six,—the developed and the underdeveloped, the sick and the well, the feebleminded and the normal, the defective and the sound,—are received into the school. As a result, the teachers are handicapped, many pupils given work for which they are not fitted, either physically or mentally, and a large percentage of retardation and failure is insured from the outset."[8]

The percentage of promotion in the first grade should be increased and the failure decreased. To achieve this purpose, it would be of great value if it were possible, at the time of application for entrance to the conventional first grade, to determine which pupils are likely to be promoted under the present program offered in this grade.

The present study attempts to determine to what extent the first grade promotion of a school beginner can be predicted from the measurement, at the time of entrance, with existing tests and scales, of the basic factors of chronological age, mental age, number of permanent teeth (an index of anatomical age) and amount of kindergarten training.

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[7] Holmes, Margaret C., "Investigation of Reading Readiness of First Grade Entrants"—Childhood Ed., Vol. III, No. 5, Jan., 1927.

[8] Burnham, William H., "Success and Failure as Conditions of Mental Health," 1919.

II

Reasons for Selecting Factors Used in Study

In a recent nation-wide investigation of practices in first grade admission, public school administrators ranked, in order: chronological age, general ability to do first grade work, physical maturity, mental age, and general health, as the first five factors in importance for determining admission of children to the first grade.[1] The questionnaire distributed in connection with Dr. Reed's study listed the following factors for determining entrance to the first grade: chronological age, mental age, general health, physical maturity, emotional stability, health habits, general conduct, and general ability to do first grade work. To these factors a few respondents added: social age, parental judgment, language, crowded conditions, and two semesters in kindergarten.

Of these thirteen separate factors listed, only four are objectively measurable with existing tests and scales: chronological age, physical maturity, mental age, and two semesters in kindergarten. The first three of these are basic measures of the child's development.

While it has been demonstrated that mental ability is the most important single factor determining school success,[2] other factors may contribute a share toward this end and must therefore be studied.[3, 4, 5]

There appear to be sound reasons for believing chronological age to be an important factor in determining the probable success or failure of the school entrant. Each month of time finds the normal child further matured in every respect. He is further advanced toward his ultimate development in mental ability, in physical and anatomical maturity, and in life experience. A child of 75 months is more mature in every way than

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[1] Reed, Mary M., *An Investigation of Practices in First Grade Admission and Promotion*, Columbia Contributions to Education No. 290, 1927.
[2] Dickson, Virgil E., *Mental Tests and the Classroom Teacher*, 1924.
[3] Kelley, Truman L., *Statistical Method*, p. 151.
[4] Courtis, S. A., *Why Children Succeed*, p. 251.
[5] Terman, Lewis M. et al., *Intelligence Tests and School Reorganization*, 1923.

he was at 72 months. Whether he is more prepared to succeed in first grade work however, while logical, is open to question. The answer might depend on the type of activity in which the child engages during the three months' lapse of time. It is possible that the longer a child delays school entrance, the more difficult will be his adjustment to school routine.

The belief has been expressed that, for school placement, chronological age is of no more value than the size of shoe the child wears.[6] On the other hand, chronological age has been held to be the best representation of that maturity and development that make for success in school work.[7] In the present study, objective evidence of the value of this factor for promotion will be sought.

The inclusion of mental age as a factor in school success needs no special argument. Many studies have indicated high correlation between mental age and school success. In Dickson's study of school children in the vicinity of Stanford University he concluded that, "Below the mental age of 6 years the child is not fully ready for the first grade, and that below the mental age of 5½ years the chances that really standard first grade work will be done are practically negligible."[8] Gates has shown a correlation of .595 between mental age and educational achievement for 58 junior primary and 57 fourth grade pupils at the Horace Mann School in New York.[9] Dickson in his more recent work states that, "Evidence has rapidly accumulated during the past few years showing that mental age is the best single criterion (though never the only one) to be used as a basis for grade classification. No other factor is so important in predicting the success with which a given child will perform the work of a given grade."[10] He subsequently shows a correlation of .725 between mental age and quality of school work with 149 first grade children.[10]

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[6] Zornow and Pechstein, "An Experiment in the Classification of First Grade Children through the Use of Mental Tests," *Elementary School Journal*, Vol. 23, No. 2, Oct., 1922, p. 136.

[7] Courtis, S. A., *Why Children Succeed*, p. 201.

[8] Terman, Lewis M., *The Intelligence of School Children*, p. 47, 1919.

[9] Gates, Arthur, "The Nature and Educational Significance of Physical Status, Mental, Psychological, Social and Emotional Maturity."

[10] Dickson, Virgil E., *op. cit.* on p. 10,—p. 48.

In the present study, the mental age was determined by the Detroit First Grade Intelligence Test, a group test of mental ability in wide use and high standing. Group tests of mental ability for classification purposes have been shown to be reasonably accurate, and to be routine procedure in many places.[11, 12] In 215 reporting cities having a population of 10,000 or more, 25 per cent reported group intelligence tests being used for admission of pupils to first grade of the elementary school.[13]

The use of some measure of anatomical maturity for admission to school and for grade classification has prominent supporters. The stage a child has reached in his total anatomical development is believed to be more significant than the amount of time taken by him to reach that particular stage. One authority concludes," . . . that requirements for entrance to school based on stage of progress in physiological development, or physiological age, would be far superior to a requirement taking account of chronological age only."[14] In other quarters it has been held that physiological age should be used as the basis for all record and investigation with children; that a child of a given anatomical age belongs in a certain school grade; and that, while mental age has significance only when compared with chronological age, it acquires additional significance when compared with anatomical age.[15, 16, 17]

Anatomical maturity and physiological maturity are accepted as meaning the same thing. It is apparently taken for granted that changes in the body structures are accompanied by the necessary adjustments of the organs.[18]

For children of the usual school entrance age, the most accepted indicators of anatomical age are the stage of ossification

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[11] Courtis, S. A., *Why Children Succeed*, p. 25.
[12] Dickson, Virgil E., *op. cit.* on p. 10, p. 83.
[13] City School Leaflet No. 20, *U. S. Bureau of Education*, March, 1925, p. 2.
[14] Beik, A. K., "Physiological Age and School Entrance," *Pedagogical Seminary*, Vo. XX, p. 303, 1913.
[15] Crampton, C. Ward, "Physiological Age—a Fundamental Principle," *American Physical Education Review*, Vol. XIII, 1908.
[16] Woodrow, Herbert and Lowell, Francis, "Anatomic Age and Its Relation to Intelligence," *Pedagogical Seminary*, Vol. XXIX, 1922.
[17] Woodrow, Herbert, *Brightness and Dullness in Children*, p. 107, 1919.
[18] Woodrow, Herbert, *Brightness and Dullness in Children*, p. 97, 1919.

of the wrist bones and the stage of eruption of the permanent teeth. Although the determination of anatomical age from Roentgen-ray pictures of the carpal bones of the wrist, using Prescott's technique,[19] is the method most favored at the present time, it requires laboratory equipment and technicians not available for the present study. The number of permanent teeth erupted, therefore, was employed as the measure of anatomical age for the following reasons:

1. The number of permanent teeth erupted has been found to show very nearly as much correlation with intelligence as the degree of carpal development (r = from .12 +0 .23).[20]
2. Time of eruption of the permanent teeth is closely related to the stage of general development.[21]
3. Permanent teeth can be rapidly, conveniently and exactly counted by almost anyone, after a little instruction, particularly in children of the first grade.
4. The permanent teeth can be counted incident to the usual health or medical inspection of the school entrant, thereby avoiding loss of the child's time.
5. Recently determined dentition age norms are now available.[22] (See page 51.)
6. No interpretative ability on the part of the counter is necessary. The permanent teeth are either present or absent. If they are visible they are counted.

The foregoing reasons have been presented to warrant the study of the possible effect of anatomical maturity on school promotion, and to warrant the use of the number of permanent teeth erupted as an index of anatomical maturity. For simplicity and clarity, however, this factor is presented throughout the study in the very specific terms of number of permanent teeth erupted. In order to make comparisons possible, Dr. Cattell's "Dentition Age—Norms (North Europeans)" is shown in Appendix I, Page 51.

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[19] Prescott, Daniel A., "The Determination of Anatomical Age in School Children," *Harvard Monograph in Education*, No. 5, 1923.
[20] Woodrow and Lowell, *op. cit.* on p. 12.
[21] Beik, A. K., *op. cit.* on p. 12.
[22] Cattell, Psyche, *Dentition as a Measure of Maturity*, Harvard Monograph in Education, No. 9, 1928.

The effect of kindergarten training on subsequent school progress of children has been, and still is, a controversial topic. Although regular progress through the grades is not set up as the prime purpose of the kindergarten, a host of its friends are of the firm opinion that the kindergarten aids a child to progress more regularly through the grades. On the other hand, there are skeptics who demand objective evidence instead of opinion, expert though it may be.

Dr. Josephine MacLatchy, in her extensive study of "Attendance at Kindergarten and Progress in the Primary Grades," draws the general conclusion, from her analysis of 15 previous studies on the effect of kindergarten training, made within the last two decades, that, "The training received at kindergarten aids the regular progress of the group through the grades of the elementary school. It is true that the verdict is not unanimous, but the burden of proof supports this conclusion."[23]

In the two studies quoted by MacLatchy in which intelligence was held constant (the studies of W. J. Peters and Regina R. Heller), the conclusions were drawn that kindergarten trained pupils progress faster, in the grades, by one-sixth of a term than pupils not so trained. MacLatchy's conclusions from her own data are more extensive and specific. She found that more of the kindergarten group came from homes rated good, while a larger part of the non-kindergarten group came from homes rated poor. The kindergarten group had better social ratings in such factors as industry, initiative, and oral language. They were also younger, due, apparently, to administrative routine. Her kindergarten group showed greater mental ability than the non-kindergarten group which showed a large proportion of dull children. She also concludes that, "Training received at kindergarten hastened the development of the ability measured by the intelligence test to a greater degree than the undirected experiences of every-day life to which the non-kindergarten children were subjected before they entered the first grade."

Dr. MacLatchey's most important conclusion, however, is that

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[23] MacLatchy, Josephine H., Attendance at Kindergarten and Progress in the Primary Grades. Ohio State U. Studies Bureau of Ed. Research Mono. No. 8, 1928.

although the kindergarten group showed a decided superiority in promotion percentage at the end of the first grade, "When the records of the groups (kindergarten and non-kindergarten) of equal ability who had scores on all the tests were considered, their promotion records were almost equal. The slight advantage fell to the kindergarten group."

In the present study, it is possible that the study of the effect of kindergarten training on first grade promotion will serve the double purpose of verifying or opposing MacLatchy's findings, and of increasing the chances for predicting first grade promotion by combination with the other factors.

A further study of the literature on first grade failure fails to disclose any investigation which deals with an entire entering group of large size, as is proposed for this study. For the most part, previous studies have dealt with the selection of under-age children who are mentally advanced, for entrance into school. These experiments are reported as giving satisfactory results, but they concern only a small portion of the school entrants.[24]

At Winnetka, under-age children were admitted on the basis of mental age, but the teachers reported that such pupils often proved too immature and babyish. Another plan was therefore adopted under which under-age children were admitted if the average of their chronological and mental ages was six years. Better results were obtained by this plan, but the first grade teachers, and even some of the second grade teachers, reported that the under-age children are often relatively immature and somewhat at a disadvantage in the group.[25]

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[24] Lincoln, Edward A., "A Scientific Method of Determining the Fitness of Under Aged Children for School," *American School Board Journal*, Feb., 1924.

[25] Washburne, Carleton, and Raths, Louis, "Selection of Under Age Children for Entrance into School," *Educational Administration and Supervision*, March, 1928.

III

Collection of Data

The data for this study were obtained from eight public schools of Philadelphia for all their white school entrants for the term beginning September, 1927. These pupils, with their classmates who had previously failed the first term work, comprised sixteen classes. The eight schools draw their pupils from homes of approximately the same social background. No one of these schools has what might be called a "typically American" enrollment. A foreign language is spoken in many of the homes in each school.

The purpose and plan of the study were presented to the principals of the schools and their active co-operation enlisted. A direction sheet for collecting the data and a class record sheet for recording the data were placed in the hands of the principals for each of the sixteen teachers of entering classes. Copies of these two sheets follow:

Directions For Class Record Sheet

Research on Success of School Beginners

This study is confined to white pupils who:

1. Are entering first grade for the first time.
2. Have presented reliable documentary proof of age, as shown on the pupil's registration card.

Therefore enter on the Class Record sheet only the names of pupils in your class who meet the above requirements.

Column Directions:

1. Number the pupils consecutively.
2. List boys on one side of sheet, girls on the other.
3. Copy date of birth from the registration card.
4. Height in inches to the nearest inch. Pupils remove shoes to be measured.

5. Weight in pounds to the nearest pound. Pupils remove shoes and all excess clothing such as coats, sweaters, hats, etc. It will be convenient to weigh and measure at the same time.
6. Compute and enter pupil's total score as directed in the folder of directions which comes with the Detroit First Grade Intelligence Test, which is the test to be used.
7. The mental age in years and months is obtained from the total score in the above-mentioned folder.
8. Total number of permanent teeth.
9. In this column record the number of months of kindergarten training in the public schools.
10. At the end of the first two weeks of the term enter a cross (X) beside the names of those pupils whose work so far leads you to think they will fail of promotion at the end of the term. Try to base this judgment entirely on the quality of the work the pupil has done in this brief period of time.

The data in the first ten columns should be ascertained and entered during the first two weeks of the term, if possible. When the data are entered, return the Class Record Sheet to the office. It will be returned to you at the end of the term when you can enter the data for Columns A and B. End of term data:

Column A. Number in order of class standing for the term is taken from the promotion sheet at the end of the term.

Column B. In the separate columns under this heading, enter a cross (X) if the named cause has contributed to the failure of the pupil, and enter a double cross (XX) in the column that indicates the chief cause of failure. This column is to be used only for the pupils who fail of promotion.

At the top of the sheet, in the places indicated, enter the total number on roll in your class, the number promoted, the number failed and the number of your pupils in this study. When you have entered all the data, please return the Class Record sheet to the office.

The study was limited to white pupils in order to eliminate a possible variable due to differences in maturity rates between the white and negro pupils, and the greater difficulty in obtaining proof of age for the negro pupils.

CLASS RECORD SHEET

RESEARCH ON SUCCESS OF SCHOOL BEGINNERS

At the end of term enter:
Total number on roll—
" " promoted—
" " failed—
" " in study—

Boys (Other side for girls)

Enter this data during Sept., 1927

1	2	3	4	5	6	7	8	9	10	A	B					
											EXPLAN. OF FAILURE					
NUMBER	NAMES (ALPHABETICALLY) LAST NAME FIRST	DATE OF BIRTH	HEIGHT (INCHES)	WEIGHT (POUNDS)	MENTAL TEST SCORE	MENTAL AGE (YRS. AND MOS.)	NUMBER PERM. TEETH	KINDERGARTEN TRAINING	FAILURE PREDICTED	RANK IN CLASS STANDING FOR TERM	IRREGULAR ATTENDANCE	FOREIGN LANGUAGE	PHYSICAL HANDICAPS	LACK OF INTEREST	"TOO BABYISH"	OTHER CAUSES

The pupils entering first grade for the first time, the real school entrants, were the only ones included in the study. The study group was further restricted to those school entrants who submitted documentary proof of age, such as a birth certificate, baptismal certificate, passport, insurance certificates, etc.

Within the foregoing limitations, every school entrant for the September 1927 term, in the eight concerned schools, was included in the study. The data for boys and girls were collected and tabulated separately in order to attempt to uncover any possible differences in their records.

The classroom teacher made out the Class Record Sheet for her own pupils and entered all data thereon.

The primary data from the class record sheet used in the present study were:

Total number on class roll
Number promoted
Number not promoted
Number in study
Date of birth
Mental age
Number of permanent teeth
Amount of kindergarten training
Rank in class standing

The first four items, and the last two, were entered by the teacher at the end of the first term and subsequently verified in every instance by the author. The same information for the second term record was obtained directly from the promotion sheets by the investigator.

The date of birth, the mental age, the number of permanent teeth, and the amount of kindergarten training were found and entered on the class record sheet within two weeks of the beginning of the school term. The dates of birth were transcribed by the teacher from the official registration cards to the class record sheet. The investigator made a sampling verification (at least every third case) of the dates of birth of the children, and of the fact that they were beginning first grade for the first time. The

age in months for every child was computed by the author from the date of birth to the nearest month, as of September 15, 1927. This date was selected because it falls in the middle of the period allotted for collecting the beginning of term data. Throughout this study, the age thus computed will be referred to as the chronological age.

The mental age used in this study was obtained from scores in the Detroit First Grade Intelligence Test. This test was worked out experimentally and carefully standardized to insure its applicability to first grade children. It consists entirely of pictures, and the child is not required to read. The pupils do no writing of any kind, but simply mark the pictures according to directions given orally by the teacher. The tests contain no special school symbols. The abilities tested are all of the type which intelligence tests as a class aim to measure, and cover practically all aspects of intelligence. The test consists of ten parts, or sub-tests, planned to measure the following abilities:

Appreciation of similarities
Memory
Comparisons
Relationships
Following directions
Information
Counting
Classification

The instructions for the test are sufficiently explicit so that the teacher can administer and score the test after a little preliminary study of the procedure. The test has no time limit, but requires from twenty to thirty minutes to administer. The mental age equivalents for the test scores were derived from results obtained from 20,000 children. Scoring is easy and objective.[1]

This test was administered by the teacher and scored by her as directed in the manual of directions for the test. The teacher translated the mental test scores into mental age equivalents

[1] Detroit First Grade Intelligence Test, by Anna M. Engel, Published by World Book Company.

according to the table of mental age equivalents given in the manual of directions for the test. The investigator verified the marking of the tests, the computation of the total scores, and the mental age equivalents for all the pupils in 13 of the 16 classes included in the study.

The number of permanent teeth was counted by the principal, or medical inspector, or school nurse, or the investigator. Where this identification and counting were done by anyone other than the investigator, the instruction sheet, shown in Appendix II, was placed in the hands of the principal before the identification was attempted.

Dr. Cattell's plan of counting a tooth as erupted if it were visible was used. She decided upon this method because she found little difference in the correlations between dental development and chronological age for scores in which stage of eruption was weighted and scores in which stage of eruption was unweighted. She notes that the use of the total number of teeth without weighting has several advantages:

1. It is simple.
2. It saves time, both in the examinations and scoring.
3. It does not require the necessity for differentiating between teeth that are "erupting", "half-way through", and "present", which is of necessity somewhat subjective.

Promotions are made semi-annually in the schools in this study, so that there were two promotion periods in the first grade for these pupils, one at the end of the first term in January, 1928, and the other at the end of the second term in June, 1928. Although there are two separate terms to the first grade, the teacher carries the class through the entire year. The pupils who were not promoted at the end of the first term, therefore, dropped out of the teacher's class and were placed in the new entering class in February, 1928.

For the purposes of this study, only those pupils who were promoted in both terms of the first grade were considered "promoted in the first grade." Therefore, whether a child failed in the first term or in the second term, or both, he was counted as not promoted in the first grade.

In these schools, regulations provide for the preparation by the teacher of a "Promotion Sheet" at the end of each term. Every child in the class must appear on this sheet, and the pupils are listed on this sheet according to the teacher's judgment of their school ability, beginning with the best pupil and ending with the pupil of lowest school ability. In a class of forty pupils, for instance, the pupils who ranked 1, 2, 3, 4, and 5 were the best pupils, and those who ranked 36, 37, 38, 39, and 40 were the lowest pupils. The quality of school work of each child, therefore, as judged by the teacher, is indicated by its ranking on the "Promotion Sheet", which will be referred to in this study as its rank in class standing.

Promotion or non-promotion, as well as relative class standing for each pupil, was made solely on the basis of the teacher's judgment. No standard tests were used by the teacher to assist in her judgment. If, in her judgment, the child during the first term displayed an accomplishment and learning ability to proceed successfully in the next grade, the child was promoted. In all cases of doubt at the end of the first term, it is very likely that the teacher promoted the child, since, if promoted, the child would remain in her class, and she would have another five-month period in which to make a decision. The constancy of the teacher's judgment in this study, as found by comparing their rankings of the same pupils for the two successive terms of the first grade, is presented in Appendix III.

Before any records were made, the principals were requested to make a personal check of the accuracy of all data collected, and to stress to the teachers concerned the importance of care and accuracy in gathering and entering the records. It is felt that definite co-operation was given to this end by all concerned.

IV

The Apparent Relation Between Each of the Four Study Factors and First Grade Promotion

Section A

Before presenting the primary data and proposing a statistical procedure essential to the problem, it is probably advisable to recall the purpose of the study. What is the value, for predicting first grade promotion, of the factors of chronological age, mental age, number of permanent teeth, and kindergarten training? Which of these four factors, or which combination of factors, will yield the best prediction of first grade promotion?

The first step is to find the relation apparently existing between each factor and promotion. This will be shown by comparing the means and the standard deviations of the promoted and non-promoted pupils in each factor, and by computing the coefficient of correlation between the factor and first grade promotion.

The next step depends entirely on the character of the correlations thus found. Since an indicated correlation between any two variables may be largely spurious, on account of the influence of other factors, it is ordinarily necessary to find relationships with the other known factors held constant, or "partialled out". By this technique, known as partial correlation, greater significance is given to the coefficient of correlation.

In the mathematical treatment of relationships, the next step would be to employ multiple correlations which show to what extent, if any, an additional factor will increase the relationship between a factor and the criterion.

This general procedure, modified of course by the character of the coefficients of correlation found between the criterion (promotion) and the four factors under study, was followed in this study.

The final step is to use that factor, or combination of factors, which is found to correlate best with promotion, as a basis for practical prediction of promotion in the first grade. In those cases where the prediction fails, a study of the child's medical

examination record and other available data is made in an effort to discover any probable cause of the variation.

In all the ensuing data and treatment thereof, the records for boys and girls are kept separate, in order to bring to light and control variations apparently due to sex.

All coefficients of correlation were computed by Dr. Harold J. Lufkin of the mathematics department of the University of Pennsylvania, with the aid of computing machines.

Section B

Since the pupils in the study were admitted to school on the basis of chronological age, the relation of this factor to promotion is studied first.

The first fact to be noted in Table I, which shows the distribution of the promoted and not promoted pupils according to chronological age, is the wide range in the chronological ages of these school entrants. The boys ranged in age from 66 to 104 months, with a mean age of 75.8 months, while the girls ranged from 66 to 95 months, with a mean age of 75.8 months, the same as that for the boys. There is a slightly greater dispersion of the boys' ages, as shown by the standard deviation which was 6.3 months for boys and 5.2 months for girls.

The most unexpected fact derived from an inspection of these distributions is the large number of boys (70 or 42 per cent) and girls (77 or 45 per cent) who delayed entrance beyond the age of 74 months. The school admission regulations in these schools require a chronological age of six years for entrance to first grade, with the proviso, however, that admission is granted if the child's sixth birthday falls within the current school term. In effect, therefore, the regulation permits first grade entrance at any age over 66 months. It might be expected, therefore, that pupils would apply for first grade entrance in the school term beginning nearest their sixth birthday. If such were the case, the mean entering age would be 72 months, with the entire age range from 69 to 74 months.

The mean chronological age of the promoted boys is very close to that for the not promoted boys, 75.4 months compared to 75.1 months, but the promoted girls are about a month older

TABLE I

DISTRIBUTION OF PROMOTED AND NOT PROMOTED PUPILS ACCORDING TO CHRONOLOGICAL AGE, WITH MEANS, STANDARD DEVIATIONS, AND COEFFICIENTS OF CORRELATION BETWEEN CHRONOLOGICAL AGE AND FIRST GRADE PROMOTION

		CHRONOLOGICAL AGE (IN MONTHS)															
	FROM: / TO:	66 / 68	69 / 71	72 / 74	75 / 77	78 / 80	81 / 83	84 / 86	87 / 89	90 / 92	93 / 95	96 / 98	99 / 101	102 / 104	TOTAL	MEANS	S. D.
BOYS	Promoted	4	34	32	16	14	2	4	4	4	0	1	1	1	117	75.4	
	Not Promoted	1	11	15	9	7	4	2	1	0	0	0	0	0	50	75.1	
	Total	5	45	47	25	21	6	6	5	4	0	1	1	1	167 70%	75.8 Promoted	6.3
GIRLS	Promoted	1	27	42	26	10	11	6	5	1	1	0	0	0	130	75.6	
	Not Promoted	0	17	11	6	5	3	3	0	0	0	0	0	0	45	74.8	
	Total	1	44	53	32	15	14	9	5	1	1	0	0	0	175 74%	75.8 Promoted	5.2

Coefficients of Correlation between Chronological Age and First Grade Promotion

Boys $r = .02$ P.E. $\pm .06$

Girls $r = .10$ P.E. $\pm .05$

than the not promoted girls, 75.6 months compared to 74.7 months.

These facts lead us to expect what is found when the coefficient of correlation between chronological age and promotion is computed. For boys r = .02, with a probable error of ± .06, while for girls r = .10 ± .05. These coefficients of correlation, as well as all others in this study in which dichotomous distributions were presented, were computed from the formula for bi-serial r as given in Kelley's "Statistical Method", page 245.

These correlations are insignificant (see page 28) and it may be concluded for these pupils that the older boys and girls do not have greater chances for promotion than their younger classmates.

Table I also shows that 70 per cent of the boys and 74 per cent of the girls were promoted through the first grade. These percentages agree with those quoted in the introduction, in which it was stated that approximately one in every four school entrants fail in the first grade. With the boys in this study, the ratio of first grade failure is nearer 1 in 3 than 1 in 4.

Section C

The analysis of the relationship between mental age and promotion is approached with the expectancy from experience, common sense, and previous studies that an appreciable correlation between these two factors exists. The closer the degree of relationship between mental age and promotion, or any other factor and promotion, the greater will be the accuracy of a prediction of promotion based on the factor.

The necessary data for a study of this factor are presented in Table II. The first point to be noted is the considerable range and dispersion in mental ages for both boys and girls. The mental ages of the boys range from 57 to 101 months, and the girls from 51 to 101 months. The mean mental ages for the boys and girls were very close, 75.8 months and 75.2 months respectively. There is practically no difference in the standard deviations for boys and girls. It will be recalled that the mean chronological ages for boys and girls were identical (75.8-page 24). A comparison of the mean mental ages with the mean chrono-

TABLE II

DISTRIBUTION OF PROMOTED AND NOT PROMOTED PUPILS ACCORDING TO MENTAL AGE, WITH MEANS, STANDARD DEVIATIONS, AND COEFFICIENTS OF CORRELATION BETWEEN MENTAL AGE AND FIRST GRADE PROMOTION

MENTAL AGE (IN MONTHS)

	From: / To:	51 53	54 56	57 59	60 62	63 65	66 68	69 71	72 74	75 77	78 80	81 83	84 86	87 89	90 92	93 95	96 98	99 101	TOTAL	MEANS	S. D.
BOYS	Promoted	0	0	3	7	13	7	10	10	11	9	12	11	8	6	6	2	2	117	76.0	
	Not Promoted	0	6	6	3	10	6	5	2	3	3	1	2	1	0	1	1	0	50	67.9	
	Total	0	6	9	10	23	13	15	12	14	12	13	13	9	6	7	3	2	167 70%	75.8 Promoted	11.3
GIRLS	Promoted	1	0	3	4	6	1 6	8	9	12	11	12	16	10	9	8	3	2	130	78.5	
	Not Promoted	2	4	6	6	8	8	2	2	1	2	2	1	1	0	0	0	0	45	65.4	
	Total	3	4	9	10	14	24	10	11	13	13	14	17	11	9	8	3	2	175 74%	75.2 Promoted	11.6

Coefficients of Correlation between Mental Age and First Grade Promotion

Boys $r = .25$ P.E. $\pm .05$

Girls $r = .49$ P.E. $\pm .04$

logical ages indicates that, mentally, this group of pupils was of average mental ability.

There is a real difference in the coefficients of correlation between mental age and promotion for boys and girls. For girls $r = .49 \pm .04$, while for boys $r = .25 \pm .05$. The difference in the significance of these two coefficients is readily ascertained from the following classification of coefficients of correlation:

Very high correlation	.95 to 1.00
High	.85 to .94
Marked	.65 to .84
Low	.40 to .64
Doubtful	.20 to .39
Insignificant	below .20

The inference that may be drawn from these data is that a fair prediction of first grade promotion can be made for the girls on the basis of mental age, but a similar prediction made for boys on this basis will not be nearly so satisfactory.

Section D

The data on the relationship between number of permanent teeth and promotion are presented in Table III. The range for the boys is from 0 to 12 permanent teeth, and for the girls from 0 to 11. Twice as many boys as girls have not erupted any permanent teeth, and the mean number of permanent teeth for the girls (4.0) is .7 of a tooth more than that for boys (3.3). The standard deviation for the boys (3.0) shows a greater dispersion of their distribution than is shown for the girls (2.6).

The mean number of permanent teeth for the promoted boys is slightly less than that for the not promoted boys, 2.9 permanent teeth compared with 3.3. This would indicate the negative correlation for boys which is found between number of permanent teeth and promotion, $r = -.04 \pm .06$.

For the promoted girls, however, the mean number of permanent teeth was 4.2, while the mean for the not promoted girls was 3.5. The coefficient of correlation for girls between number of permanent teeth and promotion is $.17 \pm .05$.

TABLE III

Distribution of Promoted and Not Promoted Pupils According to Number of Permanent Teeth, with Means, Standard Deviations, and Coefficients of Correlation Between Number of Permanent Teeth and First Grade Promotion

		Number of Permanent Teeth															
		0	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	MEANS	S. D.
Boys	Promoted	44	8	13	3	24	4	10	1	3	1	5	0	1	117	2.9	
	Not Promoted	22	2	4	1	7	0	8	1	3	1	1	0	0	50	3.3	
	Total	66	10	17	4	31	4	18	2	6	2	6	0	1	167 70%	3.4 Promoted	3.0
Girls	Promoted	23	8	17	7	27	11	23	2	6	1	4	1	0	130	4.2	
	Not Promoted	13	2	9	3	4	4	7	1	2	0	0	0	0	45	3.5	
	Total	26	10	26	10	31	15	30	3	8	1	4	1	0	175 74%	4.0 Promoted	2.6

Coefficients of Correlation between Number of Permanent Teeth and Promotion

Boys r = .04 P.E. ± .06

Girls r = .17 P.E. ± .05

For the boys, therefore, there is no relation between number of permanent teeth, an index of anatomical maturity, and first grade promotion, while the correlation found between these factors for girls is positive but still lacks significance.

Section E

The final factor to be analyzed in relation to first grade promotion is kindergarten training. Table IV presents the data necessary for this analysis. In the first place, only 34 per cent of the boys and 37 per cent of the girls received any kindergarten training. Relatively few of the pupils received more than one term (5 months) of this training.

The mean terms of kindergarten training for the promoted boys is .6 and that for not promoted boys .4. The coefficient of correlation for boys between kindergarten training and promotion is .08 ± .06.

For the promoted girls, the mean terms of kindergarten training is .57, and for the not promoted girls it is .53. The coefficient of correlation for the girls between kindergarten training and promotion is .02 ± .06.

Kindergarten training, according to these results, has no bearing on the promotion or non-promotion of a child in the first grade.

Summary

The coefficients of correlation between each of the four study factors and promotion are presented in Table V to facilitate comparisons.

TABLE IV

DISTRIBUTION OF PROMOTED AND NOT PROMOTED PUPILS ACCORDING TO AMOUNT OF KINDERGARTEN TRAINING, WITH MEANS, STANDARD DEVIATIONS AND COEFFICIENTS OF CORRELATION BETWEEN KINDERGARTEN TRAINING AND FIRST GRADE PROMOTION

		TERMS IN KINDERGARTEN						
		0	1	2	3 OR MORE	TOTAL	MEAN	S.D.
BOYS	Promoted....	73	27	11	6	117	.6	
	Not Pro.....	36	10	3	1	50	.4	
	Total.....	109	37	14	7	167 70%	.5 Promoted	.8
GIRLS	Promoted....	78	36	13	3	130	.57	
	Not Pro.....	32	7	5	1	45	.54	
	Total.....	110	43	18	4	175 74%	.52 Promoted	.77

Coefficients of Correlation between
Kindergarten Training and Promotion
Boys r = .08 P.E .± .06
Girls r = .02 P.E ± .06

TABLE V

COEFFICIENTS OF CORRELATION BETWEEN EACH OF THE FOUR STUDY FACTORS AND FIRST GRADE PROMOTION

	COEFFICIENT OF CORRELATION BETWEEN			
	CHRONOLOGICAL AGE AND PROMOTION	MENTAL AGE AND PROMOTION	NUMBER OF PERMANENT TEETH AND PROMOTION	KINDERGARTEN TRAINING AND PROMOTION
Boys.....	.02	.25	−.04	.08
Girls.....	.10	.49	.17	.02

The only correlations of any significance are those between mental age and promotion. The correlation for girls in this respect is double that for boys. This indicates that mental age is the best of the four factors for predicting promotion, and that such a prediction, made on the basis of mental age, will be more accurate for girls than for boys. A further analysis of these relationships is made in the next chapter.

V

Partial and Multiple Correlations Between the Four Study Factors and First Grade Promotion

Section A

The indicated correlation between any two variables may be largely due to the influence of other variables. Partial correlation offers the means of determining the relationship between two variables with the other variables held constant, or "partialled out". It is one of the ways in which the idea "other things being equal" is put into effect.

While the correlations found in the preceding chapter indicate that the best relationship is between mental age and promotion, for both boys and girls, it is advisable to obtain the coefficients of correlation between mental age and promotion with each of the other factors held constant, in order to determine to what extent, if any, the previously indicated correlations between mental age and promotion will be lowered.

In order to determine partial correlations, it is necessary to have the intercorrelations for all the factors. These are presented in Table VI. The distributions from which these intercorrelations were obtained are presented in Appendix IV.

These intercorrelations are of some interest in themselves. For instance, the correlation between chronological age and mental age, for both boys and girls, is insignificant. This indicates

TABLE VI

Coefficients of Correlation Between Chronological Age, Mental Age, Number of Permanent Teeth, and Kindergarten Training

Boys

	CHRONOLOGICAL AGE	MENTAL AGE	NUMBER OF PERMANENT TEETH
Mental Age.....	.11		
Number of Permanent Teeth.....	.60	.15	
Kindergarten Training.....	−.34	.09	−.32

GIRLS

	CHRONOLOGICAL AGE	MENTAL AGE	NUMBER OF PERMANENT TEETH
Mental Age.....	.14		
Number of Permanent Teeth.....	.41	.03	
Kindergarten Training.....	−.31	.14	−.19

that with this group of entrants a commensurate increase in mental age is not concomitant with an increase in chronological age. This means, of course, that the older pupils have lower intelligence quotients than their younger classmates.

In sharp contrast to the lack of correlation between mental age and chronological age is the fairly high correlation between number of permanent teeth and chronological age. The older pupils, in point of time, may not have grown proportionately older mentally, but they did reasonably well in maturing anatomically, as indicated by number of permanent teeth.

The distinctly negative correlations between chronological age and kindergarten training merely show that the children entering first grade from the kindergarten are appreciably younger than those entering without this experience. This is due in large part, of course, to administrative routine, which assures that a child already in the kindergarten will be entered in the first grade, by the school authorities, in the term nearest its sixth birthday.

This negative correlation between chronological age and kindergarten training naturally prepares one for the negative correlation that is shown between number of permanent teeth and kindergarten training, because of the fairly high correlation between chronological age and number of permanent teeth.

Insignificant correlations for both boys and girls are shown between mental age and number of permanent teeth, and mental age and kindergarten training. The low correlation between mental age and number of permanent teeth is to be expected, on account of the high correlation between chronological age and number of permanent teeth, and the low correlation between

chronological age and mental age. The low correlations between mental age and kindergarten training indicate that, on the whole, the kindergarten children did not have any special advantage over the non-kindergarten children in mental age.

The coefficients of correlation between mental age and promotion, with each of the other study factors held constant, and the coefficients of correlation between each other factor and promotion, with mental age held constant, are presented in Table VII, which also shows the zero order correlations for purposes of comparison.

By comparing the partial correlations in the first column of Table VII with the zero order correlations in the second column, the effect of partialling out the various factors can be seen to be practically negligible. The partial correlations, for the boys, between mental age and promotion, with chronological age held constant, is the same as the zero order correlation, while for girls, this first order correlation is reduced only .01 from the zero order correlation. All the other partial correlations between mental age and promotion, for both boys and girls, are either the same as the zero order correlations or reduced only .01. The conclusion may be drawn from these data that the zero order correlations indicated between mental age and promotion are not due to the effect of the various other factors studied.

It will be noticed in Table VII that, when the procedure is reversed by partialling out mental age from the correlations between the other factors, some slight changes in the correlations were made. The correlations between chronological age and promotion were lowered thereby, for both boys and girls. The partial correlation between number of permanent teeth and promotion (mental age constant) changes the zero order correlation for boys from $-.04$ to .08, but still fails to attach any significance to the correlation, with these pupils, between number of permanent teeth and promotion. For the girls, this correlation was increased from .17 to .18, but still remains insignificant.

Again, the partial correlations between kindergarten training and promotion (mental age constant) are very little different from the zero order correlations. For the boys, the partial correlation reduces the zero order correlation between kindergarten

training and promotion from .08 to .06, and for the girls, increases the correlation from .02 to .06.

These facts, therefore, indicate that no change of any significance was made in the original zero order correlations when the technique of partial correlation, the purpose of which was to hold the other known factors constant, was employed.

TABLE VII

COEFFICIENTS OF CORRELATION BETWEEN MENTAL AGE AND PROMOTION, WITH EACH OTHER FACTOR HELD CONSTANT, AND BETWEEN EACH OTHER FACTOR AND PROMOTION WITH MENTAL AGE HELD CONSTANT

		PARTIAL CORRELATIONS	ZERO ORDER CORRELATIONS	MEANING OF SUBSCRIPTS
1.	Boys.....	$r_{01.2} = .25$ $r_{02.1} = .01$	$r_{01} = .25$ $r_{02} = .02$	$_0$ = Promotion $_1$ = Mental Age $_2$ = Chronological Age
	Girls.....	$r_{01.2} = .48$ $r_{02.1} = .04$	$r_{01} = .49$ $r_{02} = .10$	
2.	Boys.....	$r_{01.3} = .26$ $r_{03.1} = .08$	$r_{01} = .25$ $r_{03} = -.04$	$_0$ = Promotion $_1$ = Mental Age $_3$ = Number of Permanent Teeth
	Girls.....	$r_{01.3} = .49$ $r_{03.1} = .18$	$r_{01} = .49$ $r_{03} = .17$	
3.	Boys.....	$r_{01.4} = .24$ $r_{04.1} = .06$	$r_{01} = .25$ $r_{04} = .08$	$_0$ = Promotion $_1$ = Mental Age $_4$ = Kindergarten Training
	Girls.....	$r_{01.4} = .49$ $r_{04.1} = .06$	$r_{01} = .49$ $r_{04} = .02$	

The general purpose of the use of the partial correlation technique in this study was to determine, so far as mathematically possible, which of the four variables correlated best with the criterion, promotion. The answer to be found from the data presented is the same as the tentative conclusion drawn from the zero order correlations, namely, mental age is the only factor in this study that shows any significant correlation with promotion, and this correlation is much greater for the girls than for the boys.

Section B

The next step is to determine what increase, if any, the addition of each other study factor to mental age will make in the

correlation between mental age and promotion. For this purpose multiple correlations are used. The coefficients of multiple correlation, presented in Table VIII, serve to show the correlation between the criterion (promotion) and the best weighted combination of mental age and each of the other three study factors.

The best weighted additions of chronological age and of kindergarten training to mental age, obtained by the use of the multiple correlation technique, do not raise the degree of correlation between mental age and promotion in the least, and the increase in the correlations for the boys of .01 and for the girls of .02, obtained by combining number of permanent teeth to mental age, are insignificant. In fact, both the multiple and zero order correlations lie well within the probable error of each other—P. E. = ± .04.

The logical deduction from these data, followed through zero order, partial, and multiple correlations, is inescapable. Mental age alone correlates as highly with promotion as any combination of the factors studied, and consequently furnishes the best basis, with these pupils, for predicting first grade promotion. The

TABLE VIII

COEFFICIENTS OF MULTIPLE CORRELATION BETWEEN PROMOTION AND MENTAL AGE COMBINED SUCCESSIVELY WITH CHRONOLOGICAL AGE, NUMBER OF PERMANENT TEETH, AND KINDERGARTEN TRAINING, WITH ZERO ORDER CORRELATIONS LISTED FOR COMPARISONS

	MULTIPLE CORRELATIONS	ZERO ORDER CORRELATIONS	MEANING OF SUBSCRIPTS
1. Boys.....	$r_{0\cdot12} = .25$	$r_{01} = .25$	$_0$ = Promotion $_1$ = Mental Age $_2$ = Chronological Age
Girls.....	$r_{0\cdot12} = .49$	$r_{01} = .49$	
2. Boys.....	$r_{0\cdot13} = .26$	$r_{01} = .25$	$_0$ = Promotion $_1$ = Mental Age $_3$ = Number of Permanent Teeth
Girls.....	$r_{0\cdot13} = .51$	$r_{01} = .49$	
3. Boys.....	$r_{0\cdot14} = .25$	$r_{01} = .25$	$_0$ = Promotion $_1$ = Mental Age $_4$ = Kindergarten Training
Girls.....	$r_{0\cdot14} = .49$	$r_{01} = .49$	

amount of correlation between mental age and promotion (boys .25, girls .49) is not such as to lead one to expect a good prediction of promotion to be made on this basis (see p. 28). However, the practical possibilities of the prediction of promotion for these pupils are examined in the next chapter.

VI

The Operation of a Prediction of First Grade Promotion on the Basis of Mental Age

In this chapter, mental age, which was found to correlate best with promotion, will be used to determine a practical prediction of promotion and its effect. Where promotion is predicted for a child on the basis of its mental age, and this child fails in the first grade, other available information at hand for this child will be introduced in an effort to account for the variation from the prediction. The other data at hand are:

Irregular attendance
Foreign language handicap
Medical examination record, including—
    Vision
    Hearing
    Nasal obstruction
    Nutrition

Section A

For making the practical prediction using mental age as the basis, Table II, originally presented on page 27, is reproduced at this point.

The promotion rate of this group of pupils will be increased to the extent that the failure pupils are barred from admission to the conventional first grade. This involves the location of that point on the distribution of the promoted and not promoted pupils according to mental age at which, if a line were drawn barring admission to conventional first grade work, the greatest percentage of the failures would be barred, while barring at the time the smallest percentage of those who were promoted.

An inspection of the distribution for boys shows that the bulk of the failures have mental ages less than six years, and that among those with mental ages of six years or more, the non-promotion is scattering. There were 76 boys whose mental ages were less than six years. Only 40 or 53 per cent of them were

TABLE II

Distribution of Promoted and Not Promoted Pupils According to Mental Age, with Means, Standard Deviations, and Coefficients of Correlation Between Mental Age and First Grade Promotion

		Mental Age (In Months)																			
	FROM: / TO:	51 53	54 56	57 59	60 62	63 65	66 68	69 71	72 74	75 77	78 80	81 83	84 86	87 89	90 92	93 95	96 98	99 101	TOTAL	MEANS	S. D.
Boys	Promoted	0	0	3	7	13	7	10	10	11	9	12	11	8	6	6	2	2	117	76.0	
	Not Promoted	0	6	6	3	10	6	5	2	3	3	1	2	1	0	1	1	0	50	67.9	
	Total	0	6	9	10	23	13	15	12	14	12	13	13	9	6	7	3	2	167 70%	75.8 Promoted	11.3
Girls	Promoted	1	0	3	4	6	16	8	9	12	11	12	16	10	9	8	3	2	130	78.5	
	Not Promoted	2	4	6	6	8	8	2	2	1	2	2	1	1	0	0	0	0	45	65.4	
	Total	3	4	9	10	14	24	10	11	13	13	14	17	11	9	8	3	2	175 74%	75.2 Promoted	11.6

Coefficients of Correlation Between Mental Age and First Grade Promotion

Boys $r = .25$ P.E. $\pm .05$

Girls $r = .49$ P.E. $\pm .04$

promoted. The chances for promotion, therefore, of a boy less than six years mental age were 53 in 100, or approximately even. On the other hand, there were 91 boys whose mental ages were six years or more. Of these, 85 per cent were promoted, so that the chances for promotion of a boy whose mental age was six years or more at time of entrance were 85 in 100. It is significant to note that the simple requirement of a mental age of six years would have raised the promotion rate in the first grade 15 per cent, *i. e.*, from 70 per cent to 85 per cent, and would have brought the first grade promotion rate up to that made by the higher grades (see page 8).

With the girls, the bulk of the not-promoted pupils falls below 5¾ years, and above this point the failure is scattered. Of 64 girls below this age, 30 or 47 per cent were promoted, and above this age 100 or 90 per cent of the 111 girls were promoted, showing a difference in chances for promotion for these two groups of 43 in 100. In this case, the requirement of a mental age of 5¾ years for admission to regular first grade work would have raised the promotion rate 16 per cent from 74 per cent to 90 per cent.

If the same mental age requirement were used for girls as for boys (six years), there would be 74 girls barred from admission, 38 or 51 per cent of whom would have been promoted, as compared with 92 in 101, or 91 per cent, promoted for girls six years or more mentally.

Of course, it will be quickly recognized from an inspection of the distributions, that no matter where the admission line is drawn, with the idea of barring from conventional first grade work those pupils who ultimately fail, there will be some pupils barred who actually would be promoted in the first grade. It is therefore equally important to consider the distribution of the promoted pupils according to mental age, as well as that of the not promoted pupils, in determining the best mental age requirement for admission.

A more detailed analysis of the chances for promotion according to mental age is presented in Table IX, which shows the percentage of promotion for the pupils according to half-year mental age groups.

TABLE IX

PERCENTAGE OF BOYS AND GIRLS PROMOTED IN FIRST GRADE IN EACH HALF-YEAR MENTAL AGE GROUP

MENTAL AGE	BOYS — NUMBER OF CASES				GIRLS — NUMBER OF CASES			
	PROMOTED	NOT PROMOTED	TOTAL	PER CENT PROMOTED	PROMOTED	NOT PROMOTED	TOTAL	PER CENT PROMOTED
4 years	..	..	..	..	1	2	3	33
4½ years	3	12	15	20	3	10	13	23
5 years	20	13	33	61	10	14	24	42
5½ years	17	11	28	61	24	10	34	71
6 years	21	5	26	81	21	3	24	88
6½ years	21	4	25	84	23	4	27	85
7 years	19	3	22	86	26	2	28	93
7½ years	12	1	13	92	17	0	17	100
8 years	4	1	5	80	5	0	5	100

It is very noticeable in Table IX that there is a great increase in chances for promotion for boys between 5½ years and 6 years. Boys at 5½ years have only 61 chances in 100 for promotion, while boys a half-year older mentally (6 years) have 81 chances in 100).

There is a corresponding jump in the promotion rates for girls. At 5 years the chances are 42 in 100, at 5½ years they jump to 71 in 100, and at 6 years to 88 in 100. The great increase in promotion rates occurs at a younger mental age for the girls than for the boys. By lowering the admission line for girls three months, to 69 months mental age, as previously suggested, a sharper rise in the promotion rate for girls is created. In this case, the promotion percentage for 5½-year-old girls is 67, while for 5¾-year-old girls the percentage of promotion is 80. These percentages indicate a break in the promotion rate about the same as found between 5½ years and 6 years for the boys.

The data in Table IX verify the fact found by the correlations between mental age and promotion that mental age will give a better prediction of promotion for the girls than for the boys.

Keeping in view the purpose of barring the greatest number of failures and the smallest number of promoted pupils, it appears then that it would be a good policy to admit to conventional first grade only those boys whose mental ages are 6 years or more, and only those girls whose mental ages are 5¾ years or more. With the boys in this study, such a policy would have eliminated 72 per cent of the failures, while barring from admission only 34 per cent of the promoted boys. Numerically, 36 of the not promoted boys and 40 of the promoted boys, approximately 1 for 1, would have been barred from the conventional first grade.

With the girls, such a policy would have eliminated 76 per cent of the non-promotion, while barring only 23 per cent of the girls who were promoted. Numerically, 34 not-promoted girls and 30 promoted girls, or approximately 1 for 1, the same ratio as found for boys, would have been barred from the conventional first grade.

Such a rule, therefore, would operate to deny admission to conventional first grade to 46 per cent of the boy applicants

and 37 per cent of the girl applicants, and, of course, would raise the great problem of the most efficient and economical disposition of the pupils thus barred.

Section B

When a mental age requirement for admission to conventional first grade is set up for the pupils in this study, there are two types of variation from the prediction:

1. Pupils whose mental ages indicate probable failure, but who nevertheless get promoted;
2. Pupils whose mental ages presage promotion, but who nevertheless fail in the first grade.

Two suppositions may be advanced to account for the promotion of those pupils whose mental age indicated probable failure. First, they were taken aback at the newness and strangeness of the situation, and were too excited emotionally to show their real worth in the mental test. Secondly, they may have had the latent mental ability, but needed the continued stimulus of school contact and experience to bring it forth.

It is interesting to note that over half of the boys and girls in this particular group ranked in the upper half of their classes in class standing. It cannot be said that the bulk of them were just barely promoted. This is shown by the following data. The 40 boys in this group were ranked for the first term in class standing[1] as follows: 5 in Group I (Highest); 18 in Group II; 16 in Group III; and 1 in Group IV (Lowest). For the second term 6 of these boys were ranked in class standing Group I; 12 in Group II; 15 in Group III and 7 in Group IV.

The 30 girls in this group showed an even better distribution according to class standing. For the first term 8 ranked in Group I; 13 in Group II; 8 in Group III; and 1 in Group IV. For the second term 8 ranked in Group I; 9 in Group II; 7 in Group III, and 6 in Group IV.

For the group of not promoted pupils whose mental ages

[1] See Appendix III for definition of class standing groups.

indicated the probability of promotion, additional information is available which might furnish a clue to the cause of their variation from the prediction. There were 14 boys and 11 girls in this group. The first additional information concerning these pupils is the record of their medical examination.

The medical examination records of all the not promoted pupils were examined, for the purpose of ascertaining if their physical condition seemed to be poor. The results of these examinations are summarized in Table X, which shows the number and percentages of not promoted pupils whose vision was normal, fair or poor; whose hearing was normal or fair; who had nasal obstruction, or slight obstruction or no nasal obstruction; and whose nutrition was normal or poor.

In compiling Table X, pupils whose eyesight tested 15-15 or 15-20 on the Snellen Card were considered normal; those who tested 15-30 were rated fair; and those who tested 15-50 or worse were rated poor. When the two eyes tested differently, the better eye was taken as the guide, except in one or two cases where the difference was very great, in which cases the eyesight was rated one step lower than the better eye rating.

The great majority (80 per cent) of the not-promoted pupils had normal vision, and only 8 per cent had poor vision. There is no reason to suspect that the eyesight of these pupils is not as good as that of promoted pupils.

The hearing of all but one of these not-promoted pupils was normal. It certainly can not be said that these pupils failed because they could not hear the instruction.

Again, in the case of nasal obstruction, these pupils do not seem to be particularly handicapped, since 86 per cent of them had no nasal obstruction, the obstruction was slight in 8 per cent of the cases, and present in only 6 per cent of the cases.

Finally, when the nutritional condition of these pupils was examined, 92 per cent of them were found to be normal and only 8 per cent were rated poor in this respect. One pupil was rated poor because very much overweight; the others who were rated poor were underweight for height, age and sex.

On the whole, these not-promoted pupils show up well in physical condition, since relatively few of them had the defects

covered by the routine medical examination. Their weakest point was vision, but even in this respect 80 per cent of them were normal.

TABLE X

SUMMARY OF MEDICAL EXAMINATIONS OF NOT PROMOTED PUPILS

	NUMBER	PERCENTAGE
Vision		
Normal	65	80%
Fair	10	12%
Poor	6	8%
Total	81	
Hearing		
Normal	80	99%
Fair	1	1%
Poor	0	
Total	81	
Nasal Obstruction		
None	70	86%
Slight	6	8%
Present	5	6%
Total	81	
Nutrition		
Normal	75	92%
Poor	6	8%
Total	81	

When the special group of 14 boys and 11 girls who were not promoted, but whose mental ages indicated the probability of promotion, were singled out from the entire not promoted group, it was found that 12 of the 14 boys and 7 of the 11 girls were normal in every item covered by the medical examination. Two of the boys and 2 of the girls had but one defect, poor vision, and 1 girl had but one defect, a nasal obstruction. The medical record of 1 girl was not available.

The failure of this special group of not promoted pupils can not be attributed to poor physical condition, as revealed by the

medical examination. It is possible, of course, that the poor vision exhibited by 4 of these pupils may have been the decisive factor in their non-promotion, but 76 per cent of this special group had no physical defects at all.

There are two more items of information available on this special group that may help to account for their failure. The first is irregularity of attendance, and the second the handicap of foreign language. Both these items were determined and entered by the teacher. In only 3 of the 25 cases was irregular attendance recorded, and in only 3 of the 25 cases was the handicap of foreign language checked as a possible cause of failure.

The additional information presented here reveals no item as a probable special cause of non-promotion.

Section C

For administrative reasons, the State law, which permits a child to enter the first grade at six years of age, has been interpreted in the schools in this study, so as to permit the admission of any child under six years of age whose sixth birthday falls within the current term. It may be of special interest to investigate the first grade promotion record of these underage pupils.

Table XI presents the promotion records and the mental age of the boys and girls under 6 years of age.

The data in Table XI would indicate that this special first grade admission provision is a good one for the boys, since 38 of the 50 concerned or 76 per cent were promoted. However, only 27 in 45 underage girls, or 67 per cent, were promoted.

When the mental ages of these underage pupils are considered in relation to promotion, it will be noted for the boys that whereas higher mental age increases chances for promotion, as is true for the entire study group, there are some boys in this group who are promoted despite mental ages of less than 66 months.

For the underage girls, the general principle that higher mental age increases the chances for first grade promotion holds good, and it is noteworthy that every one of the nine underage girls whose mental age was less than 66 months was not promoted in first grade. However, for both boys and girls, the mental age, rather than the chronological age, has been the factor determining promotion.

TABLE XI

MENTAL AGES AND FIRST GRADE PROMOTION RECORDS OF PUPILS WHO WERE LESS THAN 72 MONTHS OF AGE AT TIME OF ENTRANCE TO FIRST GRADE

		MENTAL AGE (IN MONTHS)							
		LESS THAN 66	66 to 71	72 to 77	78 to 83	84 to 89	90 to 95	96 to 101	TOTAL
BOYS	Promoted	5	8	9	3	7	4	2	38
	Not Promoted	7	3	1	0	1	0	0	12
	Total	12	11	10	3	8	4	2	50
GIRLS	Promoted	0	11	6	4	3	3	0	27
	Not Promoted	9	2	3	3	1	0	0	18
	Total	9	13	9	7	4	3	0	45

VII

Conclusions

Seventy per cent of the boys and seventy-four per cent of the girls in this entering group of pupils were promoted through the two terms of the first grade. The girls' promotion rate exceeded that for boys, even though the mean mental age and chronological age for boys and girls were approximately the same.

Both boys and girls showed a wide range in chronological age at the time of their entrance into the first grade. They ranged from 66 to 104 months in age, and almost half of them had delayed entrance at least a term beyond the time at which they were eligible for first grade admission, according to the chronological age requirement in these schools. Only 6 of the 342 pupils entered before the age of 5¾ years. Considering chronological age alone, the comment might well be made, not that many pupils entered school too soon, but that many delayed entrance too long.

When the relation of each of the four study factors, chronological age, mental age, number of permanent teeth (an index of anatomical maturity) and kindergarten training, to first grade promotion was studied in turn, it was found that the only relationship of any significance, as indicated by the coefficient of correlation, was between mental age and promotion (see Table V, page 31).

The technique of partial correlation was then used to determine to what extent, if any, the apparent relation between mental age and promotion was due to any one of the three other study factors. It was found by this procedure that not only was the indicated correlation not lowered, but that partialling out mental age from the correlations between the other three study factors and promotion did not change these correlations to any appreciable extent (see Table VII, page 35).

When multiple correlation was then employed to determine to what extent, if any, the best weighted addition of each of the other three study factors to mental age would increase the

coefficient of correlation between mental age and promotion, it was found that the increase was either zero or negligible (see Table VIII, page 36).

The conclusion seems warranted, therefore, with this study group, which was of average mental ability, with the tests and measures employed, that mental age, by itself, is the best basis for the prediction of first grade promotion.

The findings in this study on the relationship between amount of kindergarten training and subsequent school success, substantiate the conclusion of MacLatchy[1] that such training is of negligible value for improving promotion rates.

When a prediction of first grade promotion was made on the basis of mental age, it was found that, by requiring a mental age of 6 years for the boys and 5¾ years for the girls, 72 per cent and 76 per cent of the not-promoted boys and girls would have failed to meet this requirement. However, an equal number of promoted boys and girls, representing 34 per cent of the promoted boys and 23 per cent of the promoted girls, would have also failed to meet this requirement.

While it is possible, therefore, to raise the first grade promotion rate from 70 per cent to 85 per cent for the boys, and from 74 per cent to 90 per cent for the girls, by the simple expedient of requiring for admission to the conventional first grade a mental age of 6 years for the boys and 5¾ years for the girls, this will be done at the expense of barring from the conventional first grade a group of pupils who would have been promoted in this grade. This group would equal in size the group of not promoted pupils for whom non-promotion had been predicted.

With these pupils, using the proposed mental age basis for prediction, it was found that the prediction of promotion or non-promotion was correct for 68 per cent of the boys and for 77 per cent of the girls. The chances for promotion of pupils who did not meet the proposed mental age requirement were about 50 in 100, whereas those pupils who met this requirement had from 85 to 90 chances in 100 for promotion.

It is not to be inferred from the frequent use of the word

1. McLatchy, J. H.—"Attendance at Kindgergarten and Progress in the Primary Grades."

"bar" that applicants for first grade who fail to meet the suggested mental age are to be turned away from school. Rather it is to be emphasized that the chances for promotion of one group are so poor, and of the other group so good, that this mental age requirement is a good basis for an original differentiation of the applicants for first grade.

In an attempt to find the causes of the variation from the prediction of pupils whose mental ages indicated probable promotion, but who nevertheless were not promoted, the additional items of the medical examination record, irregular attendance and foreign language handicap were examined. It was found that not one of the unfavorable factors in these items operated except in an occasional case. This special group, as a whole, was in good physical condition; attended school regularly; and did not have a foreign language handicap.

A special inspection of the records of the underage pupils (those less than 72 months old), showed that they were not under any special handicap due to the underageness. Their chances for promotion, like those of the entire group, were determined largely by their mental ages.

To the schools now using homogeneous grouping in the first grade, based on mental age, this study suggests that, whereas mental age offers an effective basis for an original differentiation of school entrants, there is need of considerable flexibility of the plan and further mental testing within a short time for refining and maintaining the homogeneity of the groups. Retesting is particularly necessary for pupils who score low in the original mental test.

The writer has ever kept in mind the fact that the first grade promotion rate can be increased appreciably by employing better teachers, better methods and more suitable materials of instruction.

APPENDIX I

Dentition Age Norms (North Europeans) From Psyche Cattell—"Dentition as a Measure of Anatomical Maturity"

Boys		Girls		
NUMBER OF TEETH	AGE YRS. & MOS.	NUMBER OF TEETH	AGE YRS. & MOS.	SEX DIFFERENCE IN MONTHS
1	5–10	1	5– 9	1
2	6– 1	2	5–11	2
3	6– 4	3	6– 1	3
4	6– 6	4	6– 2	4
5	6– 9	5	6– 5	4
6	6–11	6	6– 8	3
7	7– 1	7	6–11	2
8	7– 4	8	7– 2	2
9	7– 8	9	7– 5	3
10	8– 0	10	7– 8	4
11	8– 5	11	8– 1	4
12	8–11	12	8– 7	4

APPENDIX II

How to Identify the Permanent Teeth of Six-Year-Old Pupils

The temporary teeth are twenty in number, ten in the upper jaw and ten in the lower jaw. In each jaw there are five teeth on either side of the medial line. (See diagram.) The names of temporary teeth, from the medial line back are:

Central incisors
Lateral incisors
Cuspids
First molars
Second molars

The Permanent Teeth

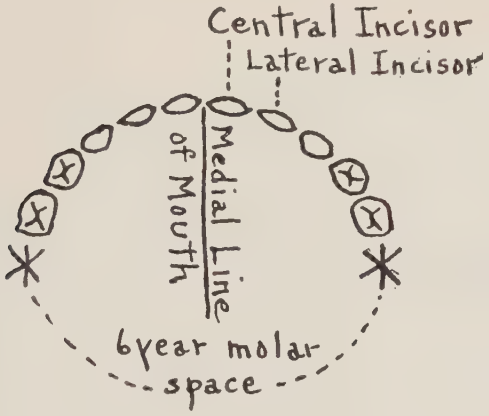
At about six years of age, the permanent teeth begin to erupt. Ordinarily, the first permanent teeth are the "six-year molars." These teeth appear in the next space behind the second molars of the baby set. They therefore occupy the sixth space back from the medial line. In many cases, the child has lost some of his "baby" teeth before the first permanent teeth arrive, so that, to be sure in identifying the six-year molars, one must count spaces back from the medial line, whether occupied by teeth or not. In practically all cases where teeth are missing, the space vacated by the tooth is unmistakable. Other aids in identifying the six-year molars are their larger size and whiter, cleaner, newer appearance.

With many six-year-old children, the six-year molar is not the first permanent tooth to appear. In these cases, the central incisors (lower or upper, or both) appear first.

The permanent incisors, lateral as well as central (these are the teeth directly in the front of the mouth), can be identified by their larger size (compared with the baby teeth); their jagged or saw edges; their cleaner appearance. Many of these will just have cut through the gums with six-year-olds.

To summarize, the permanent teeth that are likely to be erupted in a first grade child are: the six-year molars (sixth space back from medial line of mouth), the central and lateral incisors (in the front of the mouth). The permanent teeth, in this age group, are larger and cleaner. The permanent incisors have a jagged or saw edge in these children.

Be sure to include in your count the permanent teeth in the upper as well as the lower jaw. This means there may be 4 six-year molars, 4 central incisors and 4 lateral incisors for this age group.



APPENDIX III

Constancy of the Teachers' Ranking of Pupils and the Second Term Ranking of the Not Promoted Pupils

Section A

Constancy of the Teachers' Ranking of the Same Pupils for the Two Terms of the First Grade

Since each teacher ranked her pupils by ability at the end of each term, it was possible to compare her original first term rankings with her second term rankings for all pupils promoted in the first term.

In order to be able to compare results for all the pupils in the study, pupils who were ranked in the highest quarter of their classes were designated as in Group I in class standing, pupils in the second quarter were designated Group II, those in the third quarter Group III, and those in the lowest quarter of the class Group IV.

TABLE A

Second Term Class Standing Distribution of the Pupils in the First Term Class Standing Groups

(Data for Pupils Promoted in First Term)

First Term Group	No. of Cases	Second Term Class Standing Groups I	II	III	IV	Totals
I (High)	96	68	21	7	0	
II	97	18	40	25	14	0
III	77	2	13	27	35	21
IV (Low)	13	0	0	5	8	81
			0	2	36	143
Totals....	283					

These data are presented in Table A in such a manner as to show clearly the number of the total group of pupils who were ranked in the same class standing group for both terms, the number who were ranked just one class standing group removed from their first term ranking, and the number who were ranked more than one class standing group removed from the first ranking.

In the left-hand column of Table A, the first term class standing groups are listed, beginning with Group I, the highest or best group, and running down to Group IV, the lowest group. In the second column, the total number of pupils in each of these first term groups is listed. In the next four columns of the table, it is shown in which groups the pupils in each first term group were ranked for the second term. For example, there were 96 pupils ranked in class standing Group I for the first term. Reading from left to right through the next four columns, it will be found that 68 of them were ranked in Group I for the second term also, 21 were ranked in Group II, 7 in Group III, and 0 in Group IV, for the second term.

The diagonal lines, heavy, dotted, and light, running from the upper left-hand corner of the table to the lower right-hand corner, enable one to locate quickly the number who were ranked in the same group for both terms (those between the heavy solid lines), and the number who were ranked for the second term one or more groups removed from the first term ranking.

The data in this table show that 143, or 51 per cent, of the pupils were ranked by their teachers in the same class standing group for both terms, and 117 pupils, or 41 per cent, were ranked for the second term in class standing groups but one removed from their first term ranking. Furthermore, only 23 pupils, or 8 per cent of the entire group, were ranked, for the second term, two class standing groups removed from their first term rankings, and not one pupil was ranked for the second term three class standing groups, or as far as possible, from their original rankings. These data indicate a high degree of constancy in the teachers' ranking of their pupils according to quality of school work.

Section B

The second term class standing of the pupils who were not promoted in the first term is noteworthy. Data to show this distribution are presented in Table B:

Upon repeating the first term, over half of the pupils (34 in 59) who were not promoted the first time in the first term, were not only promoted on the second chance, but were ranked in the upper half of their classes. Sixteen of the 59 repeaters ranked in the upper quarter of their classes. It does not seem likely that such superior ranking was due to mere repetition of the first

term work. Rather, it seems more likely that, with these pupils, those qualities which make for promotion in the conventional first grade were not sufficiently matured at the time of school entrance. If this were the case, these particular pupils had merely started school too soon.

TABLE B

SECOND TERM CLASS STANDING DISTRIBUTION OF THE PUPILS WHO WERE NOT PROMOTED IN THE FIRST TERM

FIRST TERM CLASS STANDING GROUP	SECOND TERM CLASS STANDING GROUPS			
	I (High)	II	III	IV (Low)
I (High)	0	0	0	0
II	0	0	0	0
III	2	6	4	0
IV (Low)	14	12	18	3
Totals.....	16	18	22	3

This table also shows that a large number of the first term repeaters (25 in 59) still fail to do creditable work, despite the advantage of repetition of the work and another half-year of growth and experience. In this group of pupils are those who are promoted ultimately "on age" alone, the pupils who in time clog the grades with over-ageness, and from whom the backward classes recruit their personnel.

Perhaps the most important deduction from Table B is that in the first grade pupils are already widely differentiated as to ability to succeed in conventional school work, and, therefore, if the school program is to be adapted to the child, the adaptation must begin in this grade.

APPENDIX IV—DISTRIBUTION TABLES

DISTRIBUTION OF BOYS ACCORDING TO NUMBER OF PERMANENT TEETH AND MENTAL AGE

MENTAL AGE (IN MONTHS)

NUMBER OF PERMANENT TEETH FROM: / TO:	51 53	54 56	57 59	60 62	63 65	66 68	69 71	72 74	75 77	78 80	81 83	84 86	87 89	90 92	93 95	96 98	99 101	Total Cases
0		1	8	5	11	6	3	3	7	6	4	4	4	1	1	1	1	66
1					2		1	1	1	2		1	2					10
2		2		2	1	2	3	2			2	1			1		1	17
3						1		1						2				4
4				3	4		6	3	3	2	1	3		2	2	2		31
5					1	1			1				1					4
6		2	1		2	1	2	2		1	3	2		1	1			18
7						1							1					2
8					1					1		2	1		1			6
9		1							1									2
10					1	1			1		3							6
11																		0
12															1			1
Total Cases.....	0	6	9	10	23	13	15	12	14	12	13	13	9	6	7	3	2	167

DISTRIBUTION OF GIRLS ACCORDING TO NUMBER OF PERMANENT TEETH AND MENTAL AGE

MENTAL AGE (IN MONTHS)

NUMBER OF PERMANENT TEETH	FROM: 51 / TO: 53	54 / 56	57 / 59	60 / 62	63 / 65	66 / 68	69 / 71	72 / 74	75 / 77	78 / 80	81 / 83	84 / 86	87 / 89	90 / 92	93 / 95	96 / 98	99 / 101	TOTAL CASES
0		1	3	3	1	6	1	3	3	4	1	3	4	1	2			36
1				1		2			1	1	2	2			1			10
2	1		2	1	6	4	3				2	1		3	1	1	1	26
3				1		2			1	3		1		1		1		10
4		1		1	2	5	1	5	1	1	3	7	1	1	1		1	31
5			2	1	1	2	1			2	1		2	1	1	1		15
6	1	2	2	1	2	1	3	3	5	1	4	3	1					30
7					2				1									3
8	1			1		2	1			1			1		1			8
9											1							1
10									1				1	1	1			4
11													1					1
Total Cases.....	3	4	9	10	14	24	10	11	13	13	14	17	11	9	8	3	2	175

DISTRIBUTION OF BOYS ACCORDING TO CHRONOLOGICAL AGE AND MENTAL AGE

Mental Age (In Months)

Chronological Age (In Months) From: / To:	51 53	54 56	57 59	60 62	63 65	66 68	69 71	72 74	75 77	78 80	81 83	84 86	87 89	90 92	93 95	96 98	99 101	Total Cases
66– 68		1							1		1		2					5
69– 71			1	3	7	4	7	4	5	2		3	3	3	1	1	1	45
72– 74			4	5	8	3	4	5	2	5	6	1	2	1	1			47
75– 77		3	2	1	3	2		1	2		1	6		1	2	1		25
78—80		1	2		2	2	4	1		2	1	2	1		2		1	21
81– 83		1			2	1				1				1				6
84– 86						1		1	2	1			1					6
87– 89					1				1	1	1					1		5
90– 92				1					1		1	1						4
93– 95																		0
96– 98															1			1
99–101											1							1
102–104											1							1
Total Cases....	0	6	9	10	23	13	15	12	14	12	13	13	9	6	7	3	2	167

DISTRIBUTION OF GIRLS ACCORDING TO CHRONOLOGICAL AGE AND MENTAL AGE

MENTAL AGE (IN MONTHS)

CHRONOLOGICAL AGE (IN MONTHS) FROM: / TO:	51 53	54 56	57 59	60 62	63 65	66 68	69 71	72 74	75 77	78 80	81 83	84 86	87 89	90 92	93 95	96 98	99 101	TOTAL CASES
66– 68						1												1
69– 71			1	2	6	8	4	6	3	4	3	3	1		3			44
72– 74	1	2	2	3	4	6	4	2	6	4	5	8	2	4				53
75– 77	1	1	1	3	2	3		1	1	4	2	2	4	1	2	2	2	32
78– 80		1		2	2	4	1		3			1			1			15
81– 83	1		1			1	1	1			2	2	2	2	1			14
84– 86			4			1		1					1	2				9
87– 89										1	1	1			1	1		5
90– 92											1							1
93– 95													1					1
99–101																		0
																		0
Total Cases....	3	4	9	10	14	24	10	11	13	13	14	17	11	9	8	3	2	175

DISTRIBUTION OF BOYS ACCORDING TO CHRONOLOGICAL AGE AND NUMBER OF PERMANENT TEETH

CHRONOLOGICAL AGE (IN MONTHS)	Number of Permanent Teeth													Total Cases
	0	1	2	3	4	5	6	7	8	9	10	11	12	
66– 68	5													5
69– 71	21	5	3	2	10	2	1		1					45
72– 74	25	4	7		6	1	3		1					47
75– 77	8		4		4	1	6		2					25
78– 80	5		3	2	3		5	1	1	1				21
81– 83	1				2		2	1						6
84– 86		1			2				1		2			6
87– 89					2		1			1	1			5
90– 92	1				2						1			4
93– 95														0
96– 98													1	1
99–101											1			1
102–104											1			1
Total Cases.....	66	10	17	4	31	4	18	2	6	2	6	0	1	167

DISTRIBUTION OF GIRLS ACCORDING TO CHRONOLOGICAL AGE AND NUMBER OF PERMANENT TEETH

CHRONOLOGICAL AGE (IN MONTHS)	Number of Permanent Teeth													Total Cases
	0	1	2	3	4	5	6	7	8	9	10	11	12	
66– 68									1					1
69– 71	11	5	8	5	7	1	5	1			1			44
72– 74	14	4	10	2	13		9		1					53
75– 77	7		6	2	2	8	7							32
78– 80	1	1			1	4	4	2	2					15
81– 83	1		2		6	1	1		1		1	1		14
84– 86	2				2	1	2				2			9
87– 89				1			1		2	1				5
90– 92							1							1
93– 95									1					1
96– 98														0
99–101														0
Total Cases.....	36	10	26	10	31	15	30	3	8	1	4	1		175

DISTRIBUTION OF BOYS AND GIRLS ACCORDING TO KINDERGARTEN TRAINING AND MENTAL AGE

MENTAL AGE (IN MONTHS)

TERMS OF KINDERGARTEN TRAINING	FROM: 51	54	57	60	63	66	69	72	75	78	81	84	87	90	93	96	99	TOTAL CASES
	TO: 53	56	59	62	65	68	71	74	77	80	83	86	89	92	95	98	101	
Boys 0		5	3	7	20	7	8	7	10	7	10	10	4	3	6	1	1	109
Boys 1		1	4	2	3	5	5	2	3	2	2	1	3	2	1	1		37
Boys 2			2				1	3		3	1	2		1		1		14
Boys 3 (or more)				1		1	1		1				2				1	7
Total Cases...	0	6	9	10	23	13	15	12	14	12	13	13	9	6	7	3	2	167
Girls 0	3	2	7	9	9	15	8	6	8	8	9	6	8	5	4	2	1	110
Girls 1			3		3	5	2	3	5	4	2	10		3	2		1	43
Girls 2		1		1	1	3		2		1	3		3		2	1		18
Girls 3 (or more)					1	1						1		1				4
Total Cases.....	3	3	10	10	14	24	10	11	13	13	14	17	11	9	8	3	2	175

DISTRIBUTION OF BOYS AND GIRLS ACCORDING TO KINDERGARTEN TRAINING AND CHRONOLOGICAL AGE

Chronological Age (In Months)

Terms of Kindergarten Training: From / To	66 68	69 71	72 74	75 77	78 80	81 83	84 86	87 89	90 92	93 95	96 98	99 101	101 104	Total Cases
Boys 0	3	21	24	17	20	6	6	5	4		1	1	1	109
Boys 1	1	13	16	6	1									37
Boys 2	1	8	4	1										14
Boys 3 (or more)		3	3	1										7
Total Cases	5	45	47	25	21	6	6	5	4	0	1	1	1	167
Girls 0	1	21	26	21	12	14	8	5	1	1				110
Girls 1		15	18	8	1		1							43
Girls 2		7	6	3	2									18
Girls 3 (or more)		1	3											4
Total Cases	1	44	53	32	15	14	9	5	1	1	0	0	0	175

DISTRIBUTION OF BOYS AND GIRLS ACCORDING TO KINDERGARTEN TRAINING AND NUMBER OF PERMANENT TEETH

Terms of Kindergarten Training	Number of Permanent Teeth													Total Cases
	0	1	2	3	4	5	6	7	8	8	10	11	12	
Boys 0	34	4	10	3	22	3	17	2	5	2	6		1	109
Boys 1	18	4	5		9				1					37
Boys 2	9	2	1	1			1							14
Boys 3 (or more)	5		1			1								7
Total Cases	66	10	17	4	31	4	18	2	6	2	6	0	1	167
Girls 0	20	5	12	6	17	13	22	2	8	1	3	1		110
Girls 1	10	3	10	4	10		4	1			1			43
Girls 2	6	2	3		2	2	3							18
Girls 3 (or more)			1		2		1							4
Total Cases	36	10	26	10	31	15	30	3	8	1	4	1	0	175

APPENDIX V

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ABSTRACT OF THE THESIS

TITLE: The value of Chronological Age, Mental Age, Number of Permanent Teeth, and Kindergarten Training for Predicting Promotion in the First Grade.

Largely through the practice of admitting children to the first grade solely on the basis of chronological age, the first grade promotion rate is the lowest in the elementary school. In an effort to provide information of value for any program to increase this promotion rate, the present study presents data on the influence on promotion of chronological age, mental age, number of permanent teeth (an index of anatomical age), and amount of kindergarten training.

Through the technique of zero order and partial correlation, it was determined for this study group that mental age was the best basis for predicting first grade promotion, and that the addition of any of the other factors to mental age, by means of the multiple correlation technique, did not improve the prediction of promotion obtained through the use of mental age alone.

Predictions of promotion and non-promotion, made for the entire study group on the basis of mental age, were correct for 68 per cent of the boys and 77 per cent of the girls. However, the predictions of promotion alone were correct for 85 per cent of the boys and 90 per cent of the girls.

Mental age, as determined by a group intelligence test, offers an effective basis for an original differentiation of school entrants, but this should be followed by individual mental and school aptitude tests for those entrants whose chances for promotion as shown by the original test are poor.

REINHOLD W. GOLL.